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SMART & BIGGAR/FETHERSTONHAUGH & CO.
P.O. BOX 2999, STATION D
900-55 METCALFE STREET
OTTAWA, ON K1P5Y6
CANADA

EXAMINER	
LIOU, JONATHAN	

ART UNIT	PAPER NUMBER
2663	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/038,883	Applicant(s) MA ET AL.	
	Examiner Jonathan Liou	Art Unit 2663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 01/08/2002.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,6,7,10-14,16-18,21-23,27-29,31 and 32* is/are rejected.

7)☒ Claim(s) *5, 8-9, 15, 19-20, 24-26, 30* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01/08/2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by Wang et al. (US Pub. No. 2002/0034213.)

3. As per claim 1, Wang et al. disclosed a method of inserting pilot symbols into Orthogonal Frequency Division Multiplexing (OFDM) frames at an OFDM transmitter having at least one transmitting antenna, the OFDM frames having a time domain and a frequency domain, each OFDM frame comprising a plurality of OFDM symbols (**See sec [0003]-[0004], antenna 8 in Fig. 1, Wang et al.**), the method comprising the steps of:

for each antenna, inserting scattered pilot symbols in an identical scattered pattern in time-frequency (**Wang et al. teach that the scattered pilot could have regular or irregular scattered pattern in time-frequency. See sec [0015] and Fig. 2-3, Wang et al.**)

4. Claims 11 and 13 are rejected under 35 U.S.C. 102(e) as being anticipated by Wu et al. (US Pub. No. 2002/0122383.)

5. As per claim 11, Wu et al. teach An OFDM transmitter (**Fig. 1, Wu et al.**) comprising:

A plurality of transmit antennas (**Fig. 1, Wu et al.**)

the OFDM transmitter being adapted to insert pilot symbols into Orthogonal Frequency Division Multiplexing (OFDM) frames having a time domain and a frequency domain (**See sec [0034], Wu et al.**), each OFDM frame comprising a plurality of OFDM symbols by, for each antenna, inserting pilot symbols in an identical scattered pattern in time-frequency (**Wu et al. shows each OFDM frame comprising a plurality of OFDM symbols for each antenna as shown in Fig. 2. The sub-carrier in Wu et al.'s reference is pilot symbols as shown in Fig. 2. See sec [0018], [0063], and Fig. 2, Wu et al.**)

6. As per claim 13, Wu et al. teaches for each antenna, inserting pilot symbols in an identical scattered pattern comprises for each point in the identical scattered pattern inserting a number of pilot symbols on a single sub-carrier for N consecutive OFDM symbols, where N is the number of transmitting antennae, where N>=1 (**Wu et al. teaches parameter sub-carriers can be used scattered pilot subcarriers after decoding and this is dedicated in each OFDM symbol. The continual pilot subcarriers contain training symbols that are constant for all OFDM symbols. All training symbols could be interpreted as pilot symbols. See sec [0016] – [0018], Wu et al.**)

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 2-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US Pub. No. 2002/0034213.), in view of Rabinowitz et al. (US Pub. No. 2002/0144294.)

9. As per claim 2, Wang et al. teach the identical scattered pattern could be a regular pattern (**See sec [0015], Wang et al.**) Wang et al. does not specifically teach it could be a regular diagonal-shaped lattice. Nevertheless, Rabinowitz et al. teach scattered pilot could be in a diagonal-shaped lattice (**See Fig. 12 and sec [0101], Rabinowitz et al.**) Since Rabinowitz et al. also teaches OFDM system, it would have been obvious for one who have ordinary skill in the art at the time the invention was made to have a regular diagonal-shaped lattice for scattered pattern in OFDM system because Rabinowitz et al. disclosed the techniques could be applied to a range of orthogonal frequency-division multiplexing signal such as satellite radio signals (**See sec [0037], Rabinowitz et al.**) and by placing diagonally, it could have advantage to have the different distinct frequency subcarrier and timeslot points.

10. As per claim 3, Wang et al. teach for each antenna, inserting pilot symbols in an identical diagonal-shaped lattice comprises for each point in the identical diagonal

shaped lattice inserting a number of pilot symbols on a single sub-carrier for N consecutive OFDM symbols (**Wang et al. teach for each antenna, a number of pilot symbols are inserting to the scattered pattern. On a single subcarrier, the number of pilot symbols (At fc1, contains a number of pilot symbols shown in Fig. 3) is inserted into consecutive timeslots, which could be OFDM symbols. See sec [0024], Fig. 3, Wang et al.**) Wang et al. does not specifically teach N is the number of transmitting antennae. However, Wang et al. teach each OFDM system have one antenna (**See Fig. 1 and sec [0022], Wang et al.**) Hence, N OFDM system would have N OFDM symbols, and it would have been obvious in the ordinary skill in the art for N OFDM system would have N antennae because Wang et al. teach each OFDM system have one antenna (**See Fig. 1 and sec [0022], Wang et al.**)

11. As per claim 4, the structure of Wang et al., in view of Rabinowitz et al., teach the diagonal shaped lattice. Their structure does not specifically teach the diamond shaped lattice. However, it would have been obvious to have the diamond shaped lattice because Wang et al. teach distributed pilot symbols can have a regular or an irregular pattern, as long as the pattern is known to the receiving device performing the channel estimation (**See sec [0015], Wang et al.**) Therefore, it would have been obvious for one who have ordinary skill in the art at the time the invention was made to distribute the scattered pilot pattern into a diamond shaped lattice or other patterns as long as the pattern is known to the receiving device because Wang et al. teach placing pilot symbols into a regular or an irregular pattern (**See sec [0015], Wang et al.**)

12. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US Pub. No. 2002/0034213.), in view of Keevill et al. (US Pat. No. 6,359,938.)

13. As per claim 6, Wang et al. teaches a method of claim 1. Wang et al. does not specifically teach transmitting the pilot symbols with a power level greater than a power level of data symbols, depending upon a value reflective of channel condition. Nevertheless, the pilot symbols generally transmitted at the boosted power level, and Keevill et al. teach that as the power of pilot carriers is 4/3 the maximum power of any data carrier, a succession of correlations are performed using sets of carriers spaced at intervals of 12. One of the 12 possible sets is a correlate highly with the boosted pilot carrier power (**See col 27, lines 28-32, and col 30, lines 28-32, Keevill et al.**) The value reflective of channel conditions could be considered as the correlation of symbols. Therefore, it would have been obvious for one who have ordinary skill in the art at the time the invention was made to transmitting the pilot symbols with power level greater than data symbols because Keevill et al. teach to comparing the power level between the pilot symbols and data symbols and transmitting the pilot symbols and Wang et al. also teaches the transmitting pilot symbols, and by comparing the power level, the structure would be more correlated and efficient. (**See col 3, lines 5-25, col 27, lines 28-32, and col 30, lines 28-32, Keevill et al.**)

14. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US Pub. No. 2002/0034213.), in view of Rabinowitz et al. (US Pub. No. 2002/0144294.), and further in view of Keevill et al. (US Pat. No. 6,359,938.)

15. As per claim 7, Wang et al., in view of Rabinowitz et al. teach the method of claim 4. Their structure does not teach the pilot symbols with a power level which is dynamically adjusted to ensure sufficiently accurate reception as a function of a modulation type applied to the sub-carriers carrying data recited in the claim 7. Nevertheless, Keevill et al. teach pilots are transmitted at known power level relative to the data carriers and are modulated by a known reference sequence (**See col 30, lines 26-42, Keevill et al.**) Keevill et al. also teach the power level could adjust for the purpose of synchronizing the OFDM symbol (**See col 27, lines 21-32, Keevill et al.**) Therefore, it would have been obvious for one who have ordinary skill in the art at the time the invention was made to adjust the power level for less interference reception because Keevill et al. teach the accumulated magnitudes are correlated with the power of the scattered pilot carriers, and responsive to the correlation, a synchronizing signal is generated that identifies a carrier position of the multicarrier signal (**See col 8, lines 9-27, Keevill et al.**)

16. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US Pub. No. 2002/0034213.), in view of Baum et al. (US Pat. No. 5,867,478.)

17. As per claim 10, Wang et al. teach pilot pattern. Wang et al. does not teach the pilot pattern is cyclically offset, both in a time/frequency direction, for at least one adjacent base station to form re-use patterns. Nevertheless, Baum et al. teach the pilot code could have offset in a time direction and frequency direction and the pilot code could be reuse for adjacent unit (**See col 5, lines 56-67, col 6, lines 39-65, col 22, lines 1-6, and col 22, lines 29-32, Baum et al.**) Since Wang et al. teach the pilot

symbols pattern (**Fig. 3., Wang et al.**), it would have been obvious for one who have ordinary skill in the art at the time the invention was made to reuse the patterns while offset occurs because the interference would often occurs, such as ICI or ISI; in the channel transmission of OFDM, such as Wang et al.'s system, and Baum et al. teach the method to minimize the interference (**See col 5, lines 56-67, col 6, lines 39-65, col 22, lines 1-6, and col 22, lines 29-32, Baum et al.**)

18. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wu et al. (US Pub. No. 2002/0122383.), in view of Rabinowitz et al. (US Pub. No. 2002/0144294.)

19. As per claim 12, Wu et al. teach the identical scattered pattern in a rectangular shape (**Fig. 2-4, Wu et al.**) Wu et al. does not specifically teach it could be a regular diagonal-shaped lattice. Nevertheless, Rabinowitz et al. teach scattered pilot could be in a diagonal-shaped lattice (**See Fig. 12 and sec [0101], Rabinowitz et al.**) Since Rabinowitz et al. also teaches OFDM system, it would have been obvious for one who have ordinary skill in the art at the time the invention was made to have a regular diagonal-shaped lattice for scattered pattern in OFDM system because Rabinowitz et al. disclosed the techniques could be applied to a range of orthogonal frequency-division multiplexing signal such as satellite radio signals (**See sec [0037], Rabinowitz et al.**)

20. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wu et al. (US Pub. No. 2002/0122383.), in view of Rabinowitz et al. (US Pub. No. 2002/0144294.), and further in view of Wang et al. (US Pub. No. 2002/0034213.)

21. As per claim 14, the structure of Wu et al., in view of Rabinowitz et al., teach the diagonal shaped lattice. Their structure does not specifically teach the diamond shaped

lattice. However, Wang et al. teach distributed pilot symbols can have a regular or an irregular pattern, as long as the pattern is known to the receiving device performing the channel estimation (**See sec [0015], Wang et al.**) Therefore, it would have been obvious for one who have ordinary skill in the art at the time the invention was made to distribute the scattered pilot pattern into a diamond shaped lattice or other patterns as long as the pattern is known to the receiving device because Wang et al. teach placing pilot symbols into a regular or an irregular pattern (**See sec [0015], Wang et al.**)

22. Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu et al. (US Pub. No. 2002/0122383.), in view of Keevill et al. (US Pat. No. 6,359,938.)

23. As per claim 17, Wu et al. teaches a method of claim 11. Wu et al. does not specifically teach transmitting the pilot symbols with a power level greater than a power level of data symbols, depending upon a value reflective of channel condition. Nevertheless, the pilot symbols generally transmitted at the boosted power level, and Keevill et al. teach that as the power of pilot carriers is 4/3 the maximum power of any data carrier, a succession of correlations are performed using sets of carriers spaced at intervals of 12. One of the 12 possible sets is a correlate highly with the boosted pilot carrier power (**See col 27, lines 28-32, and col 30, lines 28-32, Keevill et al.**) The value reflective of channel conditions could be considered as the correlation of symbols. Therefore, it would have been obvious for one who have ordinary skill in the art at the time the invention was made to transmitting the pilot symbols with power level greater than data symbols because Keevill et al. teach to comparing the power level between

the pilot symbols and data symbols and transmitting the pilot symbols and Wang et al. also teaches the transmitting pilot symbols, and by comparing the power level, the structure would be more correlated and efficient. **(See col 3, lines 5-25, col 27, lines 28-32, and col 30, lines 28-32, Keevill et al.)**

24. As per claim 18, Wu et al. teach the method of claim 11. Wu et al.'s structure does not teach the pilot symbols with a power level which is dynamically adjusted to ensure sufficiently accurate reception recited in the claim 18. Nevertheless, Keevill et al. teach pilots are transmitted at known power level relative to the data carriers and are modulated by a known reference sequence **(See col 30, lines 26-42, Keevill et al.)** Keevill et al. also teach the power level could adjust for the purpose of synchronizing the OFDM symbol **(See col 27, lines 21-32, Keevill et al.)** Therefore, it would have been obvious for one who have ordinary skill in the art at the time the invention was made to adjust the power level for less interference reception because Keevill et al. teach the accumulated magnitudes are correlated with the power of the scattered pilot carriers, and responsive to the correlation, a synchronizing signal is generated that identifies a carrier position of the multicarrier signal **(See col 8, lines 9-27, Keevill et al.)**

25. Claims 21, 22, 27, and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US Pub. No. 2002/0034213.), in view of Mody et al. (US Pub. No. 2002/0181390.)

26. As per claim 21, Wang et al. teach a method of estimating a plurality of channel responses at an Orthogonal Frequency Division Multiplexing (OFDM) receiver having at least one receive antenna (**Fig. 1, Wang et al.**), the method comprising:

at each receive antenna receiving OFDM frames transmitted by at least one transmitting antenna (**transmitting antenna 8, receiving antenna 11, Fig. 1, Wang et al.**), the OFDM frames having a time domain and a frequency domain (**See sec [0003]-[0004], Wang et al.**), the OFDM frames transmitted by each antenna having pilot symbols inserted in an identical scattered pattern in time-frequency, each OFDM frame comprising a plurality of OFDM symbols (**Wang et al. teach that the scattered pilot could have regular or irregular scattered pattern in time-frequency. See sec [0015] and Fig. 2-3, Wang et al.**); for each transmit antenna, receive antenna combination:

a) using the pilot symbols of the received OFDM frames to estimate a channel response for each point in the scattered pattern; (**See sec [0004], Wang et al.**)

b) estimating the channel response of a plurality of points not on the scattered pattern by performing a two-dimensional (time direction, frequency direction) interpolation of channel responses determined for points in the scattered pattern; (**Wang et al. various filter types could be used, either two-dimension or one dimension. One dimension used would be use linear interpolation to estimate the channel response; however, two-dimension form of filter would of course use two dimensional interpolation. See sec [0008], [0026], and Fig. 3, Wang et al.**)

Wang et al. teach performing an interpolation in the time direction to estimate the channel responses corresponding to remaining OFDM sub-carriers within each OFDM symbol (**See sec [0026], Wang et al.**)

Wang et al. does not teach performing an interpolation in the frequency direction as claimed. Nevertheless, Mody et al. teach performing an interpolation in the frequency domain to estimate the channel responses response correspond to unexcited sub-carriers within OFDM training symbol (**See sec [0085], Mody et al.**) Thus, it would have been obvious for one who has ordinary skill in the art at the time the invention was made to perform a frequency interpolation because it would provide the location for each subcarriers on a certain timeslot point. In addition, the linear interpolation often are used in both domain (time or frequency) depends on the channel estimation is estimate on the same frequency subcarrier or same timeslot position.

27. As per claim 22, Wang et al. teach performing a filtering function on the channel responses prior to performing the interpolation in the frequency direction to estimate the channel responses corresponding to remaining OFDM sub-carriers within each OFDM symbol (**Wang et al. teaches performing a filtering function prior the interpolation to estimate channel response. Mody et al. teach the interpolation in the frequency domain as explain for the claim rejection 21.**)

28. As per claim 27, Wang et al. teach the method applied to a single transmitter and single receiver system (**See Fig. 1, Wang et al.**)

29. As per claim 28, Wang et al. teach a single transmitter system wherein each point in the scattered pattern contains a single pilot symbol (**each point on the grid of figure 3 contains a single pilot symbol. See sec [0004], Fig. 3, Wang et al.**)

30. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US Pub. No. 2002/0034213.), in view of Mody et al. (US Pub. No. 2002/0181390.), and further in view of Wu et al. (US Pub. No. 2002/0122383.)

31. As per claim 29, Wang et al. teach a system in which there are N=1 antennas, and wherein each point in the scatter point pattern contains pilot symbols transmitted on a subcarrier as taught in claim rejection 3 above in the office action. Wang et al. does not specifically teach a system there are N>=2 antennas and a single channel estimate being determined fro each N encoded pilot symbols. However, Wu et al. teach a system there are N>=2 antennas (**Fig. 1, Wu et al.**) Wu et al. teach the scattered pattern contains a number N of consecutive encoded pilot symbols transmitted contains a number N of consecutive encoded pilot symbols transmitted on a subcarrier (**Sk(1) and Sk(2) in Fig. 3 shows on a subcarrier having N of consecutive encoded pilot symbols. Fig. 1shows the symbols are encoded. See sec [0048], [0052], Wu et al.**) Wu et al. also teaches channel estimate could perform on each subcarrier, which each N encoded pilot symbols. (**See sec [0051], Wu et al.**) Therefore, it would have been obvious for one who have ordinary skill in the art at the time the invention was made to have N>=2 antenna to perform the channel estimation because more than one single antenna would be more efficient to receive more data.

32. Claims 23, 31, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US Pub. No. 2002/0034213.), in view of Mody et al. (US Pub. No. 2002/0181390.), and further in view of Rabinowitz et al. (US Pub. No. 2002/0144294.)

33. As per claims 23, 31, and 32, the same rationale and basis as applied to claims 21, 2, and 4 are applied.

Allowable Subject Matter

34. Claims 5, 8-9, 15, 19-20, 24-26, and 30 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Liou whose telephone number is 571-272-8136. The examiner can normally be reached on 8:00AM - 5:00PM Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky Ngo can be reached on 571-272-3139. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jonathan Liou

10/28/2005

Ricky Ngo
RICKY NGO
PRIMARY EXAMINER
10/31/05